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UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* ALLEN MCTEER

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Appeal 2008-5376  
Application 10/656,182  
Technology Center 2800

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Decided: November 24, 2008

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Before JOSEPH F. RUGGIERO, ROBERT E. NAPPI,  
and ELENI MANTIS MERCADER, *Administrative Patent Judges*.

MANTIS MERCADER, *Administrative Patent Judge*.

DECISION ON APPEAL

### STATEMENT OF THE CASE

Appellant seeks our review under 35 U.S.C. § 134 of the Examiner's final rejection of claims 74 through 80, 82 and 83. We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

### INVENTION

Appellant's claimed invention is directed to a multi-layered bond pad on which the formation of copper oxide is prevented by implanting titanium into the upper surface of the copper layer (Spec. 4:23-5:4).

Claim 74, reproduced below, is representative of the subject matter on appeal:

74. A copper bond pad for a semiconductor device, said bond pad comprising:

- a dielectric layer formed over a substrate of said semiconductor device;
- a barrier layer formed over said dielectric layer;
- a copper layer formed over said barrier layer, said copper layer having titanium implanted within and near only an upper surface of said copper layer, said copper layer being primarily copper and having a thickness of about 500 Angstroms to about 20,000 Angstroms; and
- an insulating layer over said copper layer,

wherein said implanted titanium acts to reduce formation of copper oxide on said copper layer.

### THE REJECTIONS

The Examiner relies upon the following as evidence of unpatentability:

Mahulikar	US 5,320,689	Jun. 14, 1994
Harada	US 5,565,378	Oct. 15, 1996
Hsu	US 5,661,082	Aug. 26, 1997
Okada	US 6,424,036 B1	Jul. 23, 2002
Edelstein	US 6,457,234 B1	Oct. 1, 2002
Tsai	US 6,479,389 B1	Nov. 12, 2002

The following rejections are before us for review:

1. The Examiner rejected claims 74 and 75 under 35 U.S.C. § 103(a) as being unpatentable over Okada in view of Tsai.
2. The Examiner rejected claims 76 through 78 under 35 U.S.C. § 103(a) as being unpatentable over Okada in view of Tsai and Hsu.
3. The Examiner rejected claims 79, 80, 82, and 83 under 35 U.S.C. § 103(a) as being unpatentable over Edelstein in view of Harada and Mahulikar.

Independent claim 74 and dependent claims 76 through 78 were argued as a group with claim 74 as representative. Appellant has presented no additional arguments as to the additional reference of Hsu used in rejecting claim 74, but instead relies on the same arguments provided for claim 74 (App. Br. 9). Thus, claims 76 through 78 will stand or fall with claim 74. Dependent claim 75 was argued separately.

Independent claim 79 and dependent claims 80, 82, and 83 were argued as a group with claim 79 as representative. Appellant relies on the same arguments provided for claim 79 (App. Br. 11). Thus, claims 80, 82, and 83 will stand or fall with claim 79.

## OBVIOUSNESS ISSUES

### Claims 74 through 78

With respect to claim 74 Appellant contends that the Okada and Tsai combination teaches either a copper alloy layer formed merely at the top surface of the copper layer (e.g., in Tsai Fig. 2B) or a copper alloy formed throughout the entire depth of the copper layer (e.g., in Tsai Fig. 2C; col. 5, ll. 59-64) (App. Br. 7). Thus, Appellant asserts that the combination does not teach the limitation of a “copper layer having titanium implanted within and near only an upper surface of the copper layer” as claimed (App. Br. 7). Appellant further contends that this implantation at the upper surface is important because it “acts to reduce formation of copper oxide on said copper layer” as claimed (App. Br. 8).

With respect to claim 75, Appellant asserts that Tsai teaches titanium diffusing through the entire copper layer, and thus, does not suggest diffusion in less thickness (i.e., 50-200 Angstroms) than through the complete layer of copper (App. Br. 8). Appellant stated that a preferable implantation of 50-100A results in reduction of copper oxide (App. Br. 8).

Regarding claim 74, the Examiner responds that Tsai’s Figure 2C discloses a copper alloy film with titanium 27 which is applied only to the top surface of the

pure copper layer 26 (Ans. 9). The Examiner asserts that claim 74 does not preclude diffusion of titanium throughout the copper layer (i.e., layers 26 and 27) after its implantation at the top of the copper layer (i.e., layer 27) (Ans. 9). The Examiner explains that the claim only requires that the titanium is implanted within and only at the upper surface of the copper layer which is met by Tsai's copper titanium layer 27 deposited within the copper layer (i.e., layers 26 and 27) (Ans. 9). The Examiner further responds that Tsai discloses that adding titanium to copper reduces the net amount of copper that could oxidize to copper oxide (col. 4, ll. 27-29 and Ans. 10). Regarding claim 75, the Examiner further adds that layer 27 which includes titanium is indicated having a discrete thickness (i.e., dotted line in Fig. 2C), and thus, this thickness is a result effective variable (Ans.10-11).

Has the Appellant shown that the Examiner erred by determining that Tsai teaches a copper layer having titanium implanted within and near only the upper surface of the copper layer that acts to reduce formation of copper oxide on the copper layer as claimed?

Claims 79, 80, 82, and 83

Appellant contends that the combination of Edelstein, Harada, and Mahulikar is improper because the Examiner articulated motivations which are different from Appellant's motivation (i.e., reduction of copper oxidation) (App. Br. 11). Appellant further contends that Harada improves an aluminum film and one skilled in the art would not be motivated to combine a reference that merely improves aluminum to improve a copper bond pad because copper is already better than aluminum (App. Br. 11).

The Examiner responds that the combination is proper because the

Appellant's motivation (i.e., to reduce copper oxidation) was not recited in claims 79, 80, 82, and 83 and furthermore, the Examiner articulated a different motivation (i.e., improve copper properties). The Examiner further responds that Harada was appropriately combined because Harada discloses that aluminum and at least one material, which includes copper and titanium is selected from a group added to aluminum (Ans. 12).

Has the Appellant shown that the Examiner erred by using a motivation different than Appellant's motivation for combining Edelstein, Harada, and Mahulikar and that Harada was inappropriately combined because Harada improves an aluminum layer as opposed to a copper layer?

#### FINDINGS OF FACT

The relevant facts include the following:

1. Tsai discloses a copper layer (i.e., layers 26 and 27) with titanium implanted within layer 27 and only at the upper surface of the copper layer (i.e., layers 26 and 27) (Fig. 2C).
2. Claim 74 does not preclude diffusion of titanium throughout the copper layer after titanium is implanted at the top of the copper layer (claim 74).
3. Tsai discloses that adding titanium to copper reduces the net amount of copper that could oxidize to copper oxide (col. 4, ll. 27-29).
4. The Examiner articulated a rationale for combining Edelstein, Harada, and Mahulikar in that they all relate to improving properties (i.e., resistance) of a copper material (Ans. 11).

5. The Examiner used Edelstein for the teaching of an aluminum-copper layer and used Harada to further modify Edelstein (Ans. 7).
6. Harada discloses that aluminum and at least one other material (i.e., copper and titanium) were added to an aluminum film to enhance resistance (col. 6, ll. 54-61).

### PRINCIPLES OF LAW

“[A]n indefinite article ‘a’ or ‘an’ . . . carries the meaning of ‘one or more’ in open-ended claims containing the transitional phrase ‘comprising’ . . . That ‘a’ or ‘an’ can mean ‘one or more’ is best described as a rule, rather than merely as a presumption or even a convention.” *Baldwin Graphic Systems, Inc. v Siebert, Inc.*, 512 F.3d 1338, 1342 (Fed. Cir. 2008) (internal citations omitted).

The Examiner’s articulated reasoning in the rejection must possess a rational underpinning to support the legal conclusion of obviousness. *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006). The Supreme Court, citing *In re Kahn*, 441 F.3d at 988, stated that “rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR Int’l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007). However, “the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.” *Id.*

It is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by applicant. *In re Kahn*, 441 F.3d at 987.



## ANALYSIS

*1. Has the Appellant shown that the Examiner erred by determining that Tsai teaches a copper layer having titanium implanted within and near only the upper surface of the copper layer that acts to reduce formation of copper oxide as claimed?*

Tsai discloses a copper layer (i.e., layers 26 and 27) with titanium implanted within layer 27 and only at the upper surface of the copper layer (i.e., layers 26 and 27) (Finding of Fact 1). As stated *supra*, an indefinite article “a” carries the meaning of “one or more” in open-ended claims containing the transitional phrase “comprising.” *Baldwin Graphic Systems*, 512 F.3d at 1342. Thus, claim 74 containing the transitional term comprising does not preclude Tsai’s layers 26 and 27 from being construed as “a copper layer.” Furthermore, claim 74 does not preclude diffusion of titanium throughout the copper layer (i.e., layers 26 and 27) after its implantation at the top of the copper layer (i.e., layer 27) (Finding of Fact 2). Tsai also discloses that adding titanium to copper reduces the net amount of copper that could oxidize to copper oxide (Finding of Fact 3). Thus, it necessarily follows, that titanium is implanted at a thickness (i.e., layer 27) sufficient to prevent formation of copper oxide. In other words, the thickness is a variable which achieves the recognized result of preventing copper oxidation (i.e., a result-effective variable).

Thus, Tsai teaches a copper layer (i.e., layers 26 and 27) having titanium implanted within layer 27 and near only the upper surface of the copper layer (i.e., layers 26 and 27) that acts to reduce formation of copper oxide on the copper layer as claimed (Findings of Fact 1-3).

*2. Has the Appellant shown that the Examiner erred by using a motivation different than Appellant's motivation for combining Edelstein, Harada, and Mahulikar and that Harada was inappropriately combined because Harada improves an aluminum layer as opposed to a copper layer?*

The Examiner articulated a rationale for combining Edelstein, Harada, and Mahulikar in that they all relate to improving properties (i.e., resistance) of a copper material (Finding of Fact 4). As stated *supra*, the Examiner articulated a rationale that supports the legal conclusion of obviousness (i.e., improving copper material properties). *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. at 1741. Furthermore, it is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by Appellant (i.e., reduction of copper oxidation). *In re Kahn*, 441 F.3d at 987.

The Examiner used Edelstein for the teaching of an aluminum-copper layer (Finding of Fact 5). Harada was used to further modify Edelstein. Harada discloses that aluminum and at least one other material (i.e., copper and titanium) were added to an aluminum film to enhance resistance (Finding of Fact 6). The modified layer is not an aluminum layer as asserted by Appellant, but rather, Edelstein's aluminum-copper layer modified to further add titanium and copper to enhance resistance.

## CONCLUSIONS OF LAW

1. The Appellant has not shown that the Examiner erred by determining that Tsai teaches a copper layer having titanium implanted within and near only the upper surface of the copper layer that acts to reduce formation of copper oxide as

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claimed.

2. The Appellant has not shown that the Examiner erred by using a motivation different than Appellant's motivation for combining Edelstein, Harada, and Mahulikar and that Harada was appropriately combined because Harada improves an aluminum-copper layer by adding titanium and copper to further enhance resistance.

### ORDER

The decision of the Examiner to reject claims 74 through 80, 82 and 83 under 35 U.S.C. § 103(a) is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

KIS

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